Installation Restoration Program
Final Second Quarter 1999-2000
Groundwater Monitoring Report

143rd Combat Communications Squadron
Seattle Air National Guard Station
Washington Air National Guard
Seattle, Washington

March 2000

Air National Guard
Andrews AFB, Maryland

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March 2000

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LIST OF ACRONYMS/ABBREVIATIONS

Acronym/ Abbreviation	Definition
ANG	Air National Guard
ANGS	Air National Guard Station
ARAR	Applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
CCSQ	Combat Communications Squadron
cis-1,2-DCE	Cis-1,2-dichloroethene
COC	Contaminant of concern
ERM	Environmental Resources Management
IRP	Installation Restoration Program
µg/l	Micrograms per liter
MTCA	Model Toxics Control Act
PCE	Tetrachloroethene
pH	Acidity/alkalinity
PSG	Project screening goal
QA/QC	Quality assurance/quality control
QC	Quality control
RI	Remedial Investigation
TCE	Trichloroethene
VOC	Volatile organic compound
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

Groundwater samples were collected in November 1999 at the Seattle Air National Guard Station (Seattle ANGS) in Seattle, Washington, as part of a quarterly groundwater monitoring program. Thirteen monitoring wells were sampled using low-flow purging and sampling methods. The groundwater samples were analyzed for volatile organic compounds.

Static water levels in the monitoring wells were measured prior to purging and sampling the wells. Depths to water ranged from approximately 7 to 10 feet below ground surface. The inferred groundwater flow direction was toward the southwest, consistent with previous observations.

Chlorinated volatile organic compounds (VOCs) were detected in six monitoring wells in November 1999. The detected concentrations were below Washington State Model Toxics Control Act Method A Cleanup Levels. Trichloroethene (TCE) was detected at concentrations ranging from 1.5 to 4.2 micrograms per liter (µg/l) in wells MW-4, MW-6, MW-7, and MW-8 in the southern portion of the Station. Tetrachloroethene was detected at a concentration of 3.1 µg/l in well BS-004PZ at the north end of the Station. Cis-1,2-dichloroethene was detected at a concentration of 2.2 µg/l in well MW-5 in the southern portion of the Station.

Time series plots of contaminant concentration versus groundwater elevation were produced for select monitoring wells. Portions of the data for wells MW-4 and MW-8 indicate an apparent correlation between dissolved contaminant concentrations and temporal water table fluctuations.

The source of the chlorinated VOCs detected in groundwater has not been identified. Observed TCE concentrations in monitoring wells MW-4 and MW-8 appear to depend in part on groundwater elevation, which suggests that there may be a residual contaminant source (e.g., sorbed-phase VOCs) in soils near the water table proximal to these wells. As discussed in the Phase II Remedial Investigation Report (ERM 1999a), the TCE detected in monitoring wells in the southern portion of the Station may be related to the dissolved TCE plume beneath the Boeing facility immediately south of the Seattle ANGS.

SECTION 1.0

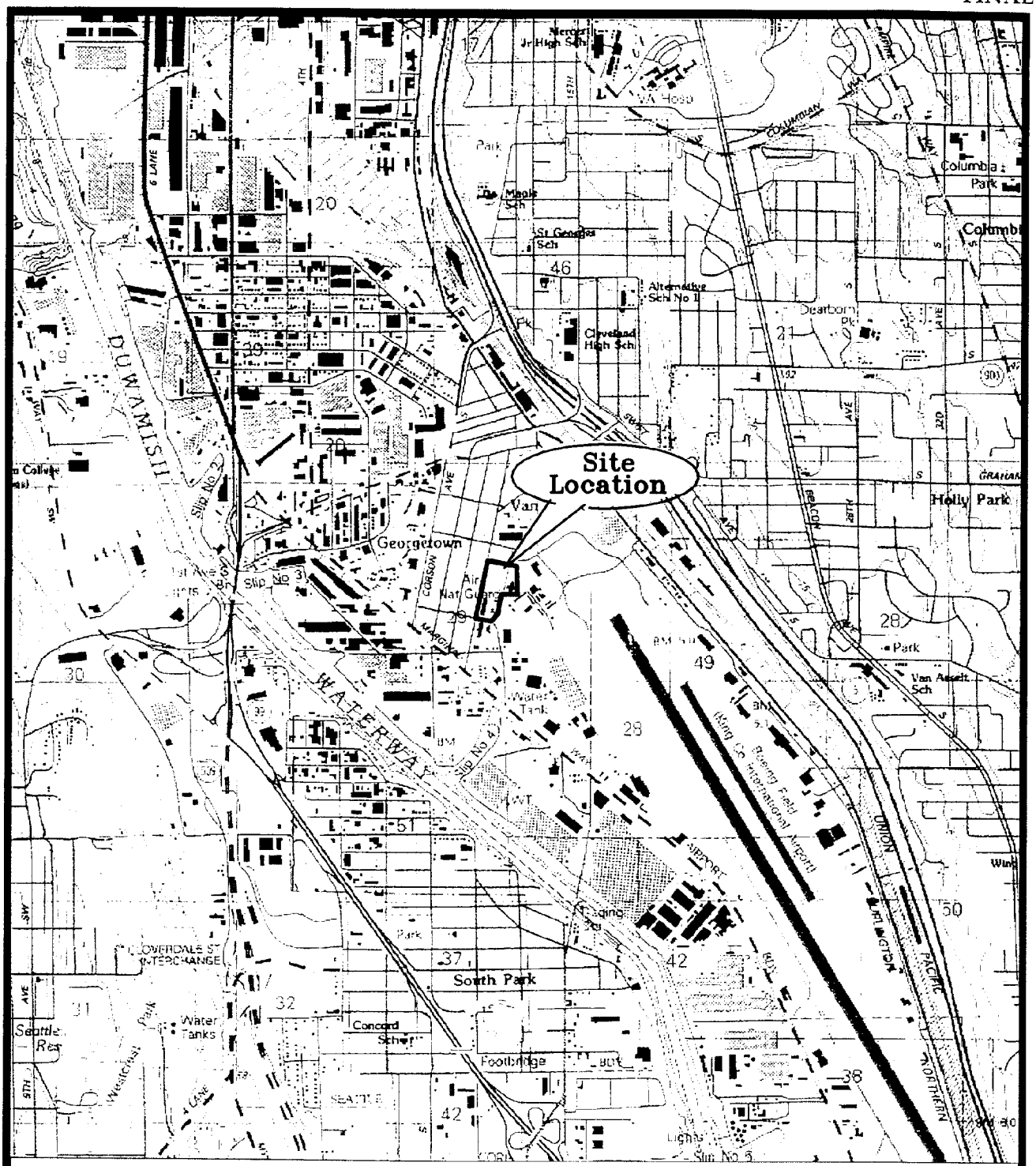
INTRODUCTION/BACKGROUND

This report summarizes the methods and results of the quarterly groundwater sampling event conducted on 23 and 24 November 1999 at the Seattle Air National Guard Station (Seattle ANGS) in Seattle, Washington (Figure 1-1). Groundwater monitoring has been conducted at the site since September 1996 as part of the Installation Restoration Program (IRP) of the Air National Guard (ANG). Environmental Resources Management (ERM) performed the work under National Guard Bureau Contract No. DAHA90-94-D-0014, Delivery Order 0067. The Air National Guard/Installation Restoration Program Branch provided technical and project management oversight of the work.

The Seattle ANGS is at 6736 Ellis Avenue South in Seattle, Washington, and occupies approximately 7.5 acres near the north end of the King County International Airport (Boeing Field). A map of the Seattle ANGS is shown in Figure 1-2. The Seattle ANGS is currently the home of the 143rd Combat Communications Squadron (CCSQ). The mission of the 143rd CCSQ is to provide mobile communication equipment and support for airports and airfields. The facility employs approximately 129 personnel, of which 25 are full-time employees.

The Seattle ANGS was built during World War II by the War Department and was used by the United States Army Air Corps as the "Aircraft Factory School." In 1948 the property was given to King County as surplus property and was subsequently leased to the Washington ANG. On 21 April 1948, the 143rd Aircraft Control and Warning Squadron was established on the site. From May 1951 to February 1953, the 143rd was activated for recruitment purposes. During this period the unit had two C-47 aircraft. In 1960 the name of the unit was formally changed to the 143rd Communications Squadron Tributary Teams. In 1969 and 1988 the name of the unit was again changed, becoming the 143rd Mobile Communications Squadron and the 143rd CCSQ, respectively.

Currently, the Seattle ANGS property is leased from King County by the United States Air Force, which in turn licenses the property to the Washington State Military Department for ANG use.



From USGS 7.5 Minute Topographic Map Series. Photographed 1977. Map Edited 1983. Seattle South, Washington

FIGURE 1-1

LOCATION MAP OF SEATTLE
AIR NATIONAL GUARD STATION
SEATTLE, WASHINGTON
143rd CCSQ, Seattle ANGS
Seattle, Washington

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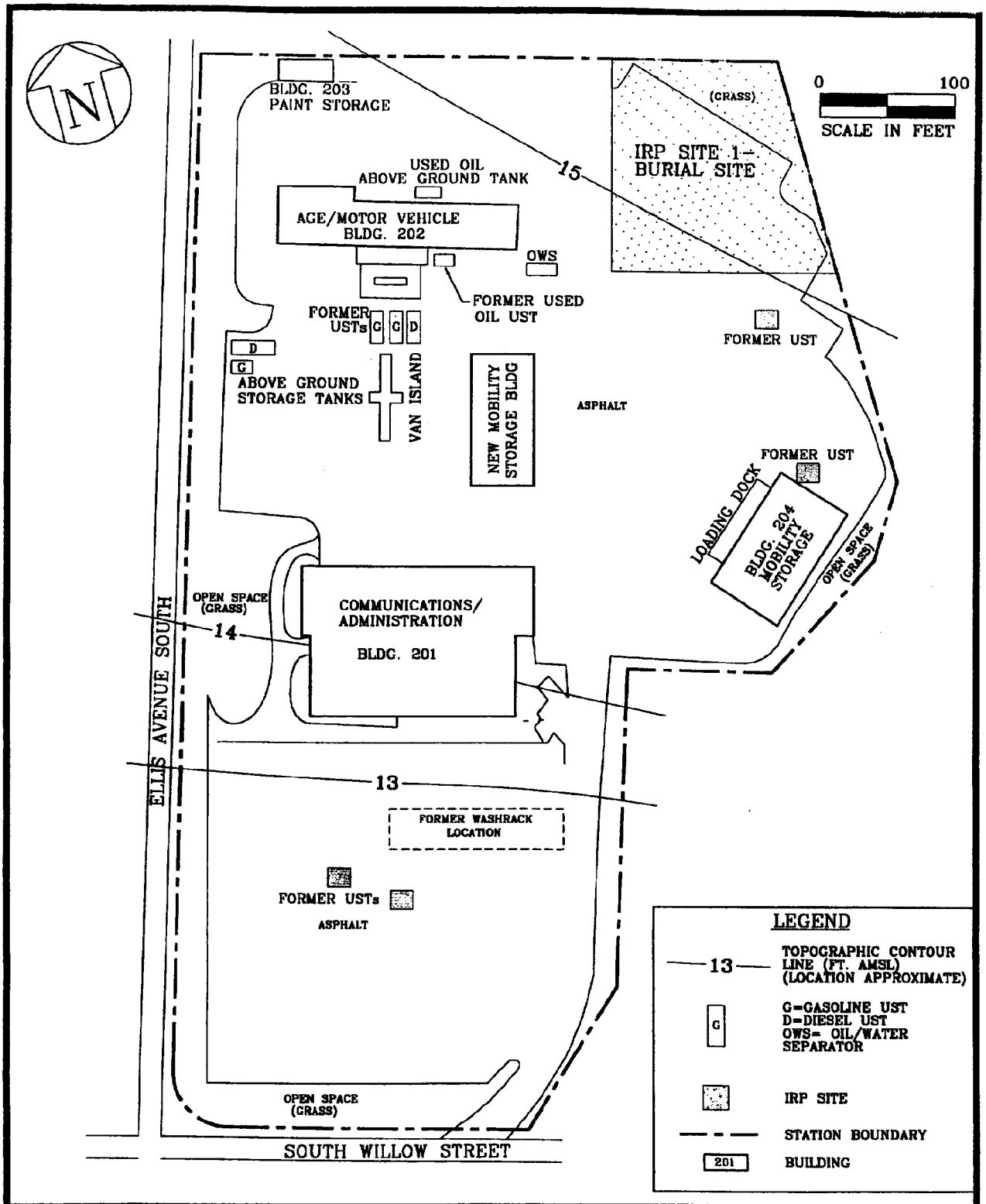

FIGURE 1-2

SITE MAP

143rd CCSQ, Seattle ANGS
Seattle, Washington

ERM

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Three IRP investigation phases have been completed at the Seattle ANGS:

- A Preliminary Assessment, conducted by the ANG in December 1993;
- A Preliminary Assessment/Site Inspection, conducted by Operational Technologies Corporation in 1994; and
- A two-part Remedial Investigation/Feasibility Study, conducted by ERM between 1996 and 1999.

The scope and results of these IRP investigations are summarized in the Phase II Remedial Investigation (RI) and Feasibility Study Reports (ERM 1999a, 1999b). Numeric project screening goals (PSGs) were developed during the RI for use in identifying contaminants of concern (COCs) in soil and groundwater. The PSGs were derived from chemical-specific State and Federal applicable or relevant and appropriate requirements (ARARs). The derivation of PSGs and the screening process used to identify COCs are described in the Phase II RI Report (ERM 1999a).

Two chlorinated volatile organic compounds (VOCs) - trichloroethene (TCE) and tetrachloroethene (PCE) - have been detected in groundwater at concentrations above PSGs. Isolated occurrences of PCE have been detected in two background (upgradient) monitoring wells; the majority of the PCE detections have been only slightly above the Washington State Model Toxics Control Act (MTCA) Method A Groundwater Cleanup Level of 5.0 micrograms per liter (µg/l). Dissolved TCE in groundwater is the only consistently detected COC at the Seattle ANGS that may pose a potential threat to human health or the environment. TCE has been detected at concentrations up to 83 µg/l in shallow groundwater in the southern portion of the Station. The MTCA Method A Cleanup Level for TCE is 5.0 µg/l.

An on-site source area for the TCE detected in groundwater has not been identified. Out of 27 soil samples analyzed for VOCs during the RI, only one was found to contain TCE. The TCE concentration reported in this sample (0.17 milligrams per kilogram) was below the MTCA Method A Soil Cleanup Level of 0.5 milligrams per kilogram. Furthermore, this soil sample was collected at the depth of the water table (approximately 10 feet below ground surface) in the southern portion of the Station, and thus may have contained TCE-impacted groundwater that biased the analytical results. Chlorinated VOCs were not detected in any of the other RI soil samples. As discussed in the Phase II RI Report (ERM 1999a), it

appears that the TCE detected in groundwater at the Seattle ANGS may be related to the groundwater contamination at the Boeing facility immediately south of the Station.

SECTION 2.0

FIELD ACTIVITIES

This section provides a summary of field activities performed during the November 1999 quarterly groundwater sampling event. Groundwater sampling was conducted on 23 and 24 November 1999 in accordance with the procedures detailed in the 1999-2000 Groundwater Monitoring Work Plan (ERM 1999c). Figure 2-1 shows the locations of the monitoring wells.

2.1 Groundwater Sampling

Groundwater samples were collected and water levels measured in the following monitoring wells: BS-004PZ, BS-005PZ, BS-006PZ, and MW-1 through MW-10. Upgradient wells BS-004PZ and MW-1 (Figure 2-1) are considered background wells.

Prior to the collection of groundwater samples, static water levels in the monitoring wells were measured to within ±0.01 foot using an electronic water level indicator. Measurements were made from established reference points marked on top of each well casing. The monitoring wells were then purged and sampled using low-flow techniques. Samples were collected for analysis of VOCs.

2.1.1 Sample Collection Procedures

Using a 2-inch diameter stainless-steel submersible pump, each monitoring well was purged at a rate of less than 500 milliliters per minute. The pump was placed between the middle and top of the screened interval in each well. The temperature, acidity/alkalinity (pH), specific conductance, turbidity, and dissolved oxygen content of the purge water were monitored during well purging using an in-line flow cell and portable water quality meter. Purging continued until specific conductance and turbidity (or dissolved oxygen) stabilized to within ±10 percent, pH to within ±0.1 units, and temperature to within ±1 degree Celsius.

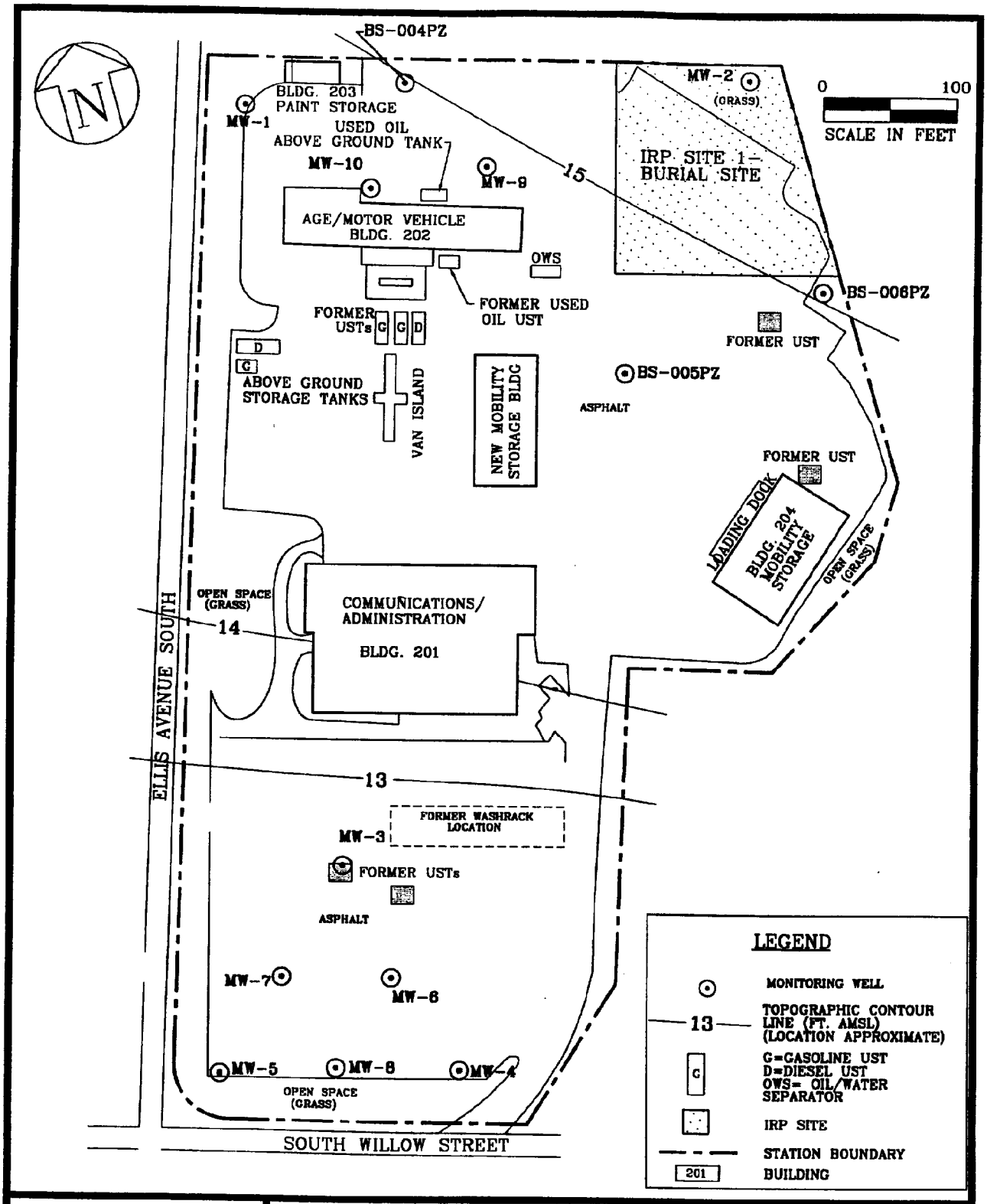

FIGURE 2-1

GROUNDWATER MONITORING WELL LOCATIONS

143rd CCSQ, Seattle ANGS
Seattle, Washington

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After each monitoring well was purged, groundwater samples were collected using the submersible pump. The samples were collected in 40-milliliter glass vials with Teflon-lined septum lids, preserved with hydrochloric acid. Immediately following sample collection, the groundwater samples were labeled and placed in coolers containing ice. The samples were delivered to the analytical laboratory under chain of custody.

A fresh length of disposable polyethylene pump-discharge tubing was used at each monitoring well. Reusable sampling equipment was decontaminated before and after use at each well. The electronic water level indicator and the submersible pump housing were washed with an aqueous solution of Liqui-Nox (a laboratory-grade detergent) followed by a tap water rinse, a rinse with American Society for Testing and Materials (ASTM) Type II reagent-grade water, and a final spray rinse with isopropanol. The submersible pump internals were decontaminated by pumping a Liqui-Nox solution, followed by tap water and ASTM Type II water, through the pump. The ASTM Type II water was produced on site from tap water using a portable water filtration system.

2.1.2 Field QA/QC Sampling

In addition to the primary groundwater samples collected from 13 groundwater monitoring wells, the following quality assurance/quality control (QA/QC) samples were collected and/or prepared:

- One equipment rinsate blank and two field blanks. ASTM Type II water was used to prepare the rinsate blank; field blanks were prepared from tap water and ASTM Type II water. The sample identifiers for the blank samples consisted of the identifier for the primary sample collected immediately prior to the blank, followed by an "R" for the rinsate blank, an "FT" for the tap water field blank, and an "FA" for the ASTM Type II water field blank.

- One duplicate sample from monitoring well MW-8. The sample identifier for the field duplicate sample was the same as the associated primary sample, followed by a "D".

- One sample for matrix spike/matrix spike duplicate analysis. The sample collected from monitoring well MW-5 was designated for the matrix spike/matrix spike duplicate analysis.

- One trip blank. The trip blank was prepared by the laboratory using reagent water, and accompanied the sample containers in the cooler in transit to the field and back to the laboratory.

2.1.3 Groundwater Sample Analyses

The groundwater samples were analyzed for VOCs using United States Environmental Protection Agency (USEPA) Method 8260. MultiChem Analytical Services in Renton, Washington performed the analyses. A summary of the samples submitted for laboratory analysis is shown in Table 2-1.

2.2 Investigation-Derived Waste Management

Purge water and decontamination water was collected and stored in 55-gallon drums. The groundwater analytical results were used to designate the drum contents as dangerous or non-dangerous waste in accordance with Washington State Dangerous Waste Regulations, Washington Administrative Code Chapter 173-303.

The purge water and decontamination water was determined not to be a Washington-defined dangerous waste. Accordingly, the purge water and decontamination water can be discharged to the sanitary sewer if approved by the local publicly owned treatment works (King County Department of Natural Resources, Wastewater Division). Alternatively, the purge water and decontamination water may be disposed at a facility that is permitted to receive and dispose of industrial wastewater, or at a permitted dangerous waste treatment, storage, and disposal facility.

TABLE 2-1

Summary of Groundwater Samples and Analytical Methods, November 1999
143rd CCSQ, Seattle ANGS, Seattle, Washington

Matrix	Sampling Method	Field Parameters	Laboratory Parameters	Analytical Method	Primary Sample Analyses	QA/QC Samples					Total Laboratory Analyses
						Trip Blank	Rinsate Blank	Field Blank	Field DUP	MS/MSD	
Groundwater	Low-flow sampling; 13 MWs, quarterly for 1 year	S.C., Turbidity, pH, Temperature, D.O.	VOCs	USEPA 8260	13	1	1	2	1	1	19

Notes:
VOC = Volatile organic compound
QA/QC = Quality assurance/quality control
DUP = Duplicate sample
pH = Acidity/alkalinity
S.C. = Specific conductance
D.O. = Dissolved oxygen content
USEPA = United States Environmental Protection Agency
MS/MSD = Matrix spike/matrix spike duplicate
MW = Monitoring well

SECTION 3.0

RESULTS

This section summarizes the results of the November 1999 groundwater sampling event at the Seattle ANGS.

3.1 Groundwater Level Data Results

Static water levels measured in the monitoring wells on 23 and 24 November 1999 ranged from approximately 7 to 10 feet below ground surface. Depth measurements were converted to groundwater elevations by subtracting the measured depth to water in each well from the known elevation of the wellhead (top of well casing). A potentiometric surface map generated from the groundwater elevation data is presented in Figure 3-1. The inferred direction of groundwater flow was toward the southwest, generally consistent with previous measurements. Cumulative water level data for the Seattle ANGS monitoring wells are included in Appendix A.

3.2 Field Parameter Results

Before groundwater samples were collected from each monitoring well, the well was purged until field parameter measurements stabilized. The final field parameter measurements are summarized in Table 3-1.

3.3 Analytical Results

The analytical testing results for the November 1999 groundwater samples are summarized in Table 3-2. Table 3-2 also includes the results for groundwater samples collected during the RI and previous quarterly sampling events, and the PSGs derived from chemical-specific ARARs. The analytical testing results for the field QC blank samples are summarized in Table 3-3. Copies of the laboratory data summary

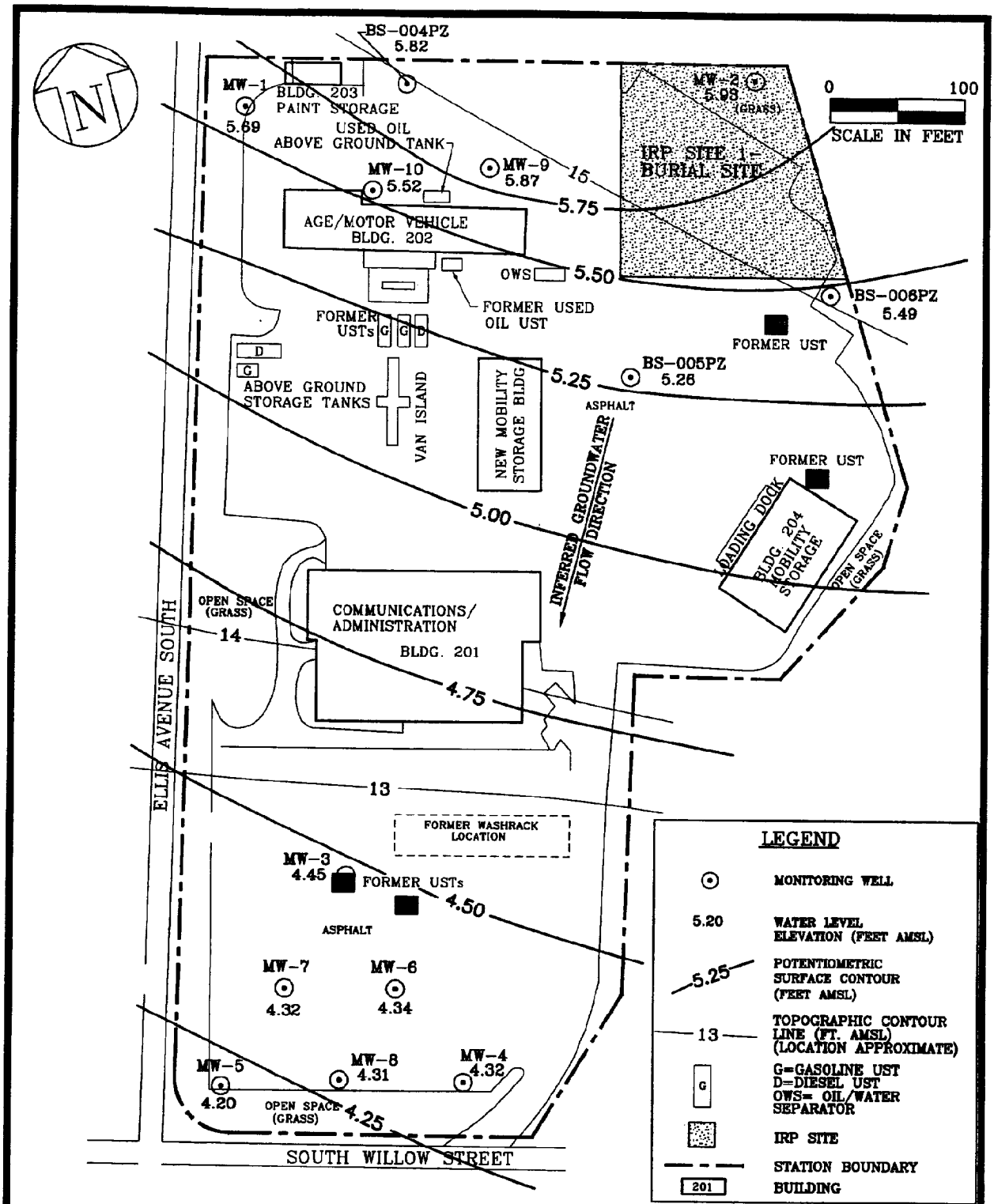

FIGURE 3-1

POTENTIOMETRIC SURFACE MAP
23-24 NOVEMBER 1999

143rd CCSQ, Seattle ANGS
Seattle, Washington

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TABLE 3-1

Final Field Parameter Measurements During Monitoring Well Purging, November 1999
143rd CCSQ, Seattle ANGS, Seattle, Washington

Monitoring Well	Field Parameters				
	Temperature (Degrees Celsius)	pH	Specific Conductance (µS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/l)
BS-004PZ (Background Well)	15.7	5.95	448	41	5.76
BS-005PZ	16.4	5.96	535	0.3	1.97
BS-006PZ	14.6	6.11	570	2.3	4.31
MW-1 (Background Well)	14.8	6.16	466	2.2	2.31
MW-2	14.0	5.68	478	15	2.63
MW-3	16.2	6.16	488	0.8	2.52
MW-4	16.0	6.14	699	0.0	1.68
MW-5	13.7	6.04	691	4.1	2.00
MW-6	16.8	6.17	517	3.5	1.79
MW-7	15.8	6.13	559	19	1.85
MW-8	15.7	6.29	632	16	1.72
MW-9	15.1	6.21	435	38	2.44
MW-10	15.2	6.09	426	4.5	1.97

Notes:
pH = Acidity/alkalinity
µS/cm= Microsiemens per centimeter
NTU = Nephelometric turbidity units
mg/l = Milligrams per liter

TABLE 3-2

Organic Constituents Detected in Groundwater Monitoring Wells
143rd CCSQ, Seattle ANGS, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloro-methane	1,1-Dichloroethane	1,1,1-Trichloroethane	Cis-1,2-Dichloroethene	1,3,5-Trimethylbenzene	Trichloroethene	Tetrachloroethene
BS-004PZ (Background Well)	09/17/1996	ND	ND	(ND)	ND	0.3	3.7	ND	ND	ND	3.8
	9/17/96 (dup)	ND	ND	(ND)	ND	0.3	3.8	ND	ND	ND	3.8
	01/14/1997	ND	ND	ND	ND	ND	2.4	ND	ND	ND	5.1
	04/11/1997	ND	ND	ND	ND	ND	3.3	ND	ND	ND	17
	07/10/1997	ND	ND	ND	ND	ND	1.8	ND	ND	ND	(ND)
	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	2.0
	11/25/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/19/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	5.8
	08/25/1999	ND	(ND)	ND	(ND)	ND	ND	ND	NA	ND	ND
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	3.1
BS-005PZ	09/17/1996	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND
	01/15/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	04/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	07/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.7
	09/01/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/25/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
BS-006PZ	09/17/1996	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND
	01/14/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	04/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	07/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
MW-1 (Background Well)	10/18/1996	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/17/1996	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	01/14/1997	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND
	04/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	07/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	09/01/1998	ND	ND	6.0	ND	ND	ND	ND	NA	ND	ND
	11/25/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	5.2
	05/19/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	08/25/1999	ND	(ND)	ND	(ND)	ND	ND	ND	NA	ND	ND
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND

TABLE 3-2

Organic Constituents Detected in Groundwater Monitoring Wells
143rd CCSQ, Seattle ANGS, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloro-methane	1,1-Dichloroethane	1,1,1-Trichloroethane	Cis-1,2-Dichloroethene	1,3,5-Trimethylbenzene	Trichloroethene	Tetrachloroethene
MW-2	10/18/1996	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/17/1996	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	01/15/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1/15/97 (dup)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	04/10/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	07/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/25/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
MW-3	10/18/1996	18	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10/18/96 (dup)	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/17/1996	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	12/17/96 (dup)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	01/15/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	04/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	07/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	9/2/98 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/98 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	02/25/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	1.2
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
MW-4	10/18/1996	11	ND	ND	ND	ND	ND	ND	ND	3.9	ND
	12/17/1996	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND
	01/14/1997	ND	ND	ND	ND	ND	ND	ND	ND	3.4	ND
	04/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	3.2	ND
	07/11/1997	ND	ND	ND	ND	ND	ND	ND	ND	2.8	ND
	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	2.0	ND
	11/24/1998	ND	ND	ND	ND	ND	ND	ND	NA	3.4	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	2.6	ND
	2/24/99 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	2.6	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	ND	NA	2.9	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	3.3	ND
	11/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	2.4	ND

TABLE 3-2

Organic Constituents Detected in Groundwater Monitoring Wells
143rd CCSQ, Seattle ANGS, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloromethane	1,1-Dichloroethene	1,1,1-Trichloroethane	Cis-1,2-Dichloroethene	1,3,5-Trimethylbenzene	Trichloroethene	Tetrachloroethene
MW-5	10/18/1996	ND	ND	ND	ND	ND	ND	5.6	ND	ND	ND
	12/17/1996	ND	ND	ND	ND	ND	ND	4.9	ND	ND	ND
	01/14/1997	ND	ND	ND	ND	ND	ND	2.7	ND	ND	ND
	04/11/1997	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND
	4/11/97 (dup)	ND	ND	ND	ND	ND	ND	1.6	ND	ND	ND
	07/10/1997	ND	ND	ND	ND	ND	ND	3.5	ND	2.1	(ND)
	7/10/97 (dup)	ND	ND	ND	ND	ND	ND	2.8	ND	ND	ND
	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/1998	ND	ND	ND	ND	ND	ND	3.2	NA	ND	ND
	02/25/1999	ND	ND	ND	ND	ND	ND	1.7	NA	ND	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/23/1999	ND	ND	ND	ND	ND	ND	2.2	NA	ND	ND
MW-6	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	3.0	ND
	11/24/1998	ND	ND	ND	ND	ND	ND	ND	NA	3.0	ND
	02/25/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	1.0	NA	3.7	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	3.5	ND
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	2.9	ND
MW-7	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/1998	ND	ND	ND	ND	ND	ND	ND	NA	3.8	ND
	02/25/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	1.9	1.7
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	1.5	ND
MW-8	09/02/1998	ND	ND	ND	ND	ND	ND	ND	NA	3.0	ND
	11/24/1998	ND	ND	ND	ND	ND	ND	ND	NA	3.3	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	39	NA	83	ND
	2/24/99 (dup)	ND	ND	ND	ND	ND	ND	42	NA	87	ND
	05/18/1999	ND	ND	ND	ND	ND	ND	4.5	NA	19	ND
	5/18/99 (dup)	ND	ND	ND	ND	ND	ND	4.7	NA	21	ND
	08/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	7.2	ND
	8/24/99 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	6.7	ND
	11/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	4.2	ND
	11/24/99 (dup)	ND	ND	ND	ND	ND	ND	ND	NA	4.3	ND
MW-9	09/01/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/24/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/18/1999	ND	ND	ND	ND	ND	1.4	ND	NA	ND	1.8
	08/24/1999	ND	ND	ND	ND	ND	2.0	ND	NA	ND	1.9
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND

TABLE 3-2

Organic Constituents Detected in Groundwater Monitoring Wells
143rd CCSQ, Seattle ANGS, Seattle, Washington

Location	Date	Acetone	Chloroform	Toluene	Bromodichloro-methane	1,1-Dichloroethane	1,1,1-Trichloroethane	Cis-1,2-Dichloroethene	1,3,5-Trimethylbenzene	Trichloroethene	Tetrachloroethene
MW-10	09/01/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	11/25/1998	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	02/24/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	05/19/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
	08/25/1999	ND	(ND)	ND	(ND)	ND	ND	ND	NA	ND	ND
	11/23/1999	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND
RI Project Screening Goal		800	--	40	--	800	200	70	0.507	5.0	5.0

All concentrations in micrograms per liter (µg/l)
ND = Not detected above laboratory method reporting limit
(ND) = A positive detection was reported by the laboratory for this constituent in the sample indicated. The sample result was qualified as not detected based on a detection of the constituent in an associated quality control blank (United States Environmental Protection Agency Contract Laboratory Program "10x" and "5x" rules).
NA = Not analyzed
dup = Duplicate sample
RI = Remedial Investigation
Shaded cell/bold typeface indicates a value exceeding the associated RI project screening goal.
-- = RI project screening goal not established

TABLE 3-3

Constituents Detected in Field Quality Control Blank Samples, November 1999
143rd CCSQ, Seattle ANGS, Seattle, Washington

Type	Date	Sample Number	Volatile Organic Compounds	
			Bromodichloro-methane	Chloroform
Field Blank (Tap Water)	11/23/1999	MW-5-99/00-2FT	1.0	37
Field Blank (ASTM Type II Water)	11/23/1999	MW-5-99/00-2FA	ND	ND
Rinsate Blank	11/24/1999	MW-8-99/00-2R	ND	ND
Trip Blank	11/23/1999	TB112399-1	ND	ND

Notes:
All concentrations in micrograms per liter (µg/l).
ASTM = American Society for Testing and Materials
ND = Not detected above laboratory method reporting limit.

sheets are included in Appendix B. The QC Data Validation Report is included in Appendix C. Appendix D contains copies of the Chain-of-Custody Forms.

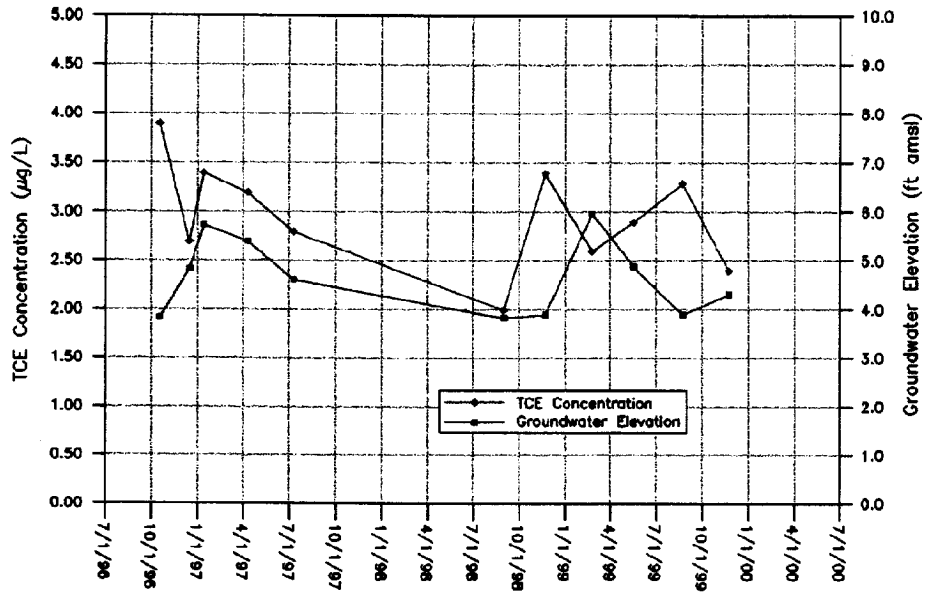
3.3.1 Groundwater Samples

TCE was detected below the PSG in the groundwater samples collected from monitoring wells MW-4, MW-6, MW-7, and MW-8. PCE was detected below the PSG in the groundwater sample collected from well BS-004PZ. Cis-1,2-dichloroethene (cis-1,2-DCE) was detected below the PSG in the groundwater sample collected from well MW-5.

Time series plots of groundwater elevation and TCE, PCE, and cis-1,2-DCE concentrations were produced for wells BS-004PZ, MW-4, MW-5, and MW-8 to determine whether measured contaminant concentrations correlate with groundwater fluctuations beneath the Station. The time series plots are shown in Figures 3-2 and 3-3. Portions of the data for wells MW-4 and MW-8 indicate an apparent corrrelation between contaminant concentration and groundwater elevation (Figure 3-2). No clear correlation is evident in the data for wells MW-5 and BS-004PZ.

3.3.2 Field QC Blank Samples

Field QC blank samples (Table 3-3) were analyzed for the same parameters as the associated groundwater samples. Chloroform and bromodichloromethane were detected in the tap water field blank. These compounds are common residual byproducts of the drinking water chlorination process, and were likely present in the source water used to prepare the tap water field blank. Chloroform and bromodichloro-methane were not detected in any groundwater samples.



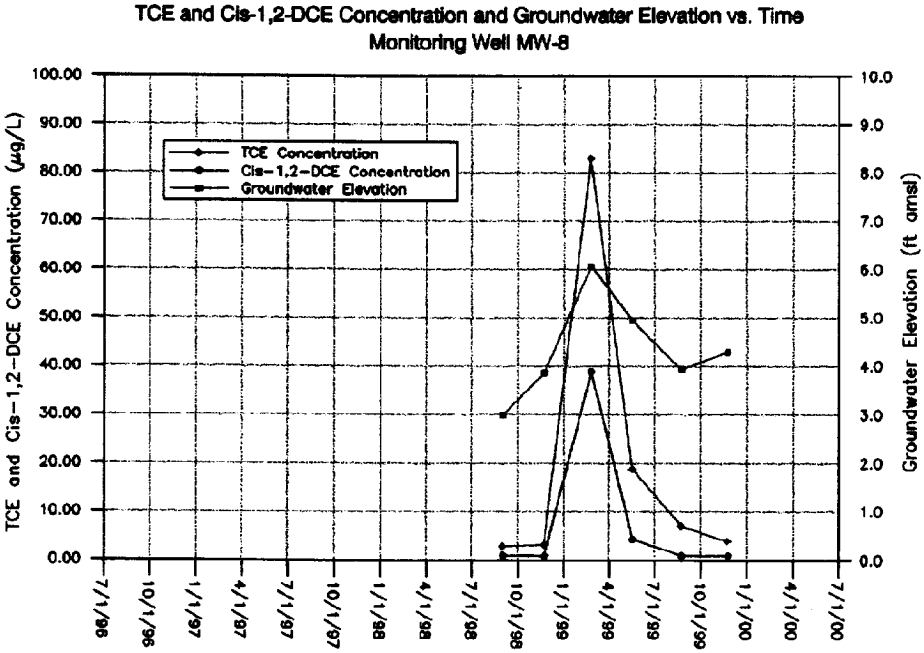


FIGURE 3-2

CONTAMINANT CONCENTRATION AND GROUNDWATER ELEVATION VS. TIME

WELLS MW-4 AND MW-8

143rd CCSQ, SEATTLE ANGS
SEATTLE, WASHINGTON

ERM

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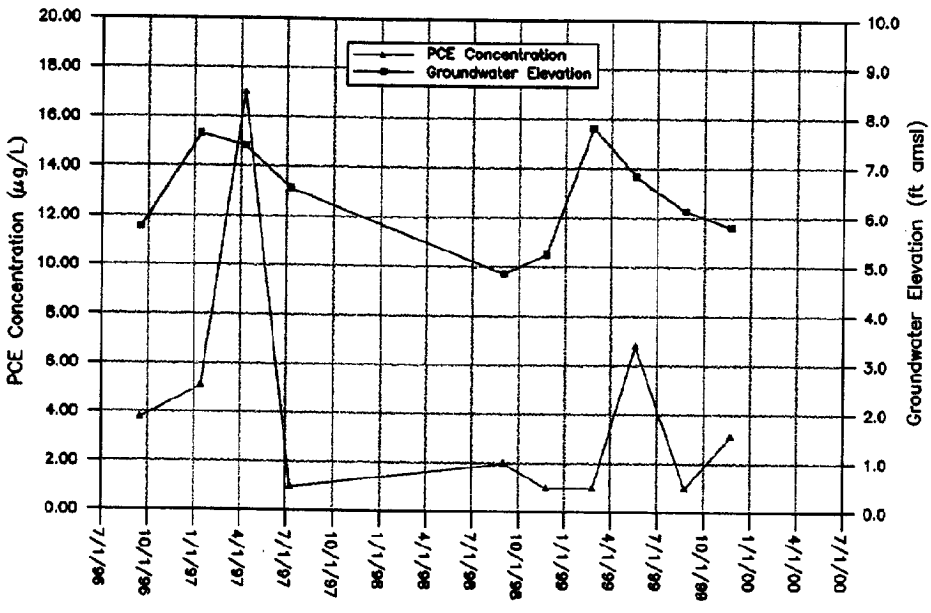

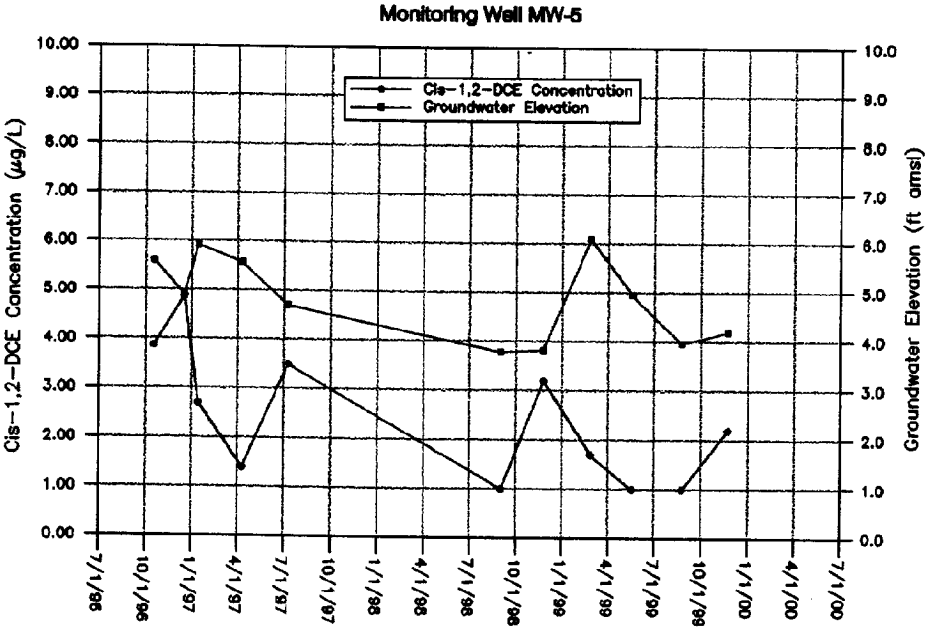

FIGURE 3-3

CONTAMINANT CONCENTRATION AND GROUNDWATER ELEVATION VS. TIME

WELLS BS-004PZ AND MW-5

143rd CCSQ, SEATTLE ANGS
SEATTLE, WASHINGTON

ERM

G:\\6067\42
60674291.dwg, 3/29/00

SECTION 4.0

CONCLUSIONS

Groundwater samples collected at the Seattle ANGS in November 1999 were analyzed for VOCs. The chlorinated compounds PCE, TCE, and/or cis-1,2-DCE were detected below Washington State MTCA Method A Cleanup Levels in select monitoring wells near the southern Station boundary and at the north end of the Station.

The highest chlorinated VOC concentration detected to date in groundwater was TCE at 83 µg/l in monitoring well MW-8 (February 1999). Concentrations of TCE in this well have steadily declined over the last three quarterly sampling events; the concentration detected in November 1999 (4.2 µg/l) was below the MTCA Method A Cleanup Level of 5.0 µg/l.

Time series plots of contaminant concentration versus groundwater elevation were produced for monitoring wells BS-004PZ, MW-4, MW-5, and MW-8. Portions of the data for wells MW-4 and MW-8 indicate an apparent correlation between dissolved contaminant concentrations and temporal water table fluctuations. This correlation is less apparent in wells MW-5 and BS-004PZ.

The source of the chlorinated VOCs detected in groundwater has not been identified. Observed TCE concentrations in monitoring wells MW-4 and MW-8 appear to depend in part on groundwater elevation, which suggests that there may be a residual contaminant source (e.g., sorbed-phase VOCs) in soils near the water table proximal to these wells. As discussed in the Phase II RI Report (ERM 1999a), the TCE detected in monitoring wells in the southern portion of the Station may be related to the dissolved TCE plume beneath the Boeing facility immediately south of the Seattle ANGS.

SECTION 5.0

REFERENCES

Environmental Resources Management (ERM). 1999a. *Installation Restoration Program Final Phase II Remedial Investigation Report, 143rd Combat Communications Squadron, Seattle Air National Guard Station.* August 1999.

_____. 1999b. *Installation Restoration Program Final Phase II Feasibility Study Report, 143rd Combat Communications Squadron, Seattle Air National Guard Station.* August 1999.

_____. 1999c. *Installation Restoration Program Final 1999-2000 Groundwater Monitoring Work Plan, 143rd Combat Communications Squadron, Seattle Air National Guard Station.* September 1999.

Appendix A

APPENDIX A

WATER LEVEL DATA

TABLE A-1

Monitoring Well Water Level Summary
143rd CCSQ, Seattle ANGS, Seattle, Washington

Monitoring Well	Measuring Point Elevation (ft amsl)	Date	Depth to Water (ft bmp)	Water Level Elevation (ft amsl)
BS-004PZ (Background Well)	14.66	9/17/96	8.88	5.78
		10/22/96	8.93	5.73
		12/17/96	8.08	6.58
		1/14/97	6.98	7.68
		4/11/97	7.23	7.43
		7/10/97	8.08	6.58
		9/1/98	9.79	4.87
		11/24/98	9.39	5.27
		02/24/1999	6.84	7.82
		05/18/1999	7.81	6.85
		08/25/1999	8.50	6.16
		11/23/1999	8.84	5.82
BS-005PZ	14.39	9/17/96	9.16	5.23
		10/22/96	9.42	4.97
		12/17/96	8.51	5.88
		1/15/97	7.48	6.91
		4/10/97	7.65	6.74
		7/11/97	8.47	5.92
		9/1/98	10.12	4.27
		11/24/98	9.41	4.98
		02/24/1999	7.32	7.07
		05/18/1999	8.15	6.24
		08/24/1999	9.19	5.20
		11/23/1999	9.13	5.26
BS-006PZ	14.59	9/17/96	9.12	5.47
		10/22/96	9.47	5.12
		12/17/96	8.54	6.05
		1/14/97	7.62	6.97
		4/11/97	7.77	6.82
		7/11/97	8.49	6.10
		9/1/98	10.29	4.30
		11/24/98	9.37	5.22
		02/24/1999	7.42	7.17
		05/28/1999	8.20	6.39
		08/24/1999	9.16	5.43
		11/23/1999	9.10	5.49

TABLE A-1

Monitoring Well Water Level Summary
143rd CCSQ, Seattle ANGS, Seattle, Washington

Monitoring Well	Measuring Point Elevation (ft amsl)	Date	Depth to Water (ft bmp)	Water Level Elevation (ft amsl)
MW-1 (Background Well)	14.92	10/22/96	9.18	5.74
		12/17/96	8.20	6.72
		1/14/97	7.11	7.81
		4/10/97	7.58	7.34
		7/11/97	8.51	6.41
		9/1/98	10.22	4.70
		11/24/98	9.45	5.47
		02/24/1999	7.12	7.80
		05/18/1999	8.25	6.67
		08/25/1999	8.78	6.14
		11/23/1999	9.23	5.69
MW-2	14.60	10/22/96	8.89	5.71
		12/17/96	8.03	6.57
		1/15/97	7.13	7.47
		4/10/97	7.25	7.35
		7/11/97	7.98	6.62
		9/1/98	9.59	5.01
		11/24/98	9.75	4.85
		02/24/1999	6.70	7.90
		05/18/1999	7.71	6.89
		08/24/1999	8.68	5.92
		11/23/1999	8.67	5.93
MW-3	11.88	10/22/96	7.77	4.11
		12/17/96	6.78	5.10
		1/15/97	7.80	4.08
		4/11/97	6.06	5.82
		7/11/97	6.94	4.94
		9/1/98	8.09	3.79
		11/24/98	7.20	4.68
		02/24/1999	5.56	6.32
		05/18/1999	6.65	5.23
		08/24/1999	7.05	4.83
		11/23/1999	7.43	4.45
MW-4	12.05	10/22/96	8.20	3.85
		12/17/96	7.21	4.84
		1/14/97	6.31	5.74
		4/11/97	6.65	5.40
		7/11/97	7.43	4.62
		9/1/98	8.21	3.84
		11/24/98	8.14	3.91
		02/24/1999	6.08	5.97
		05/18/1999	7.16	4.89
		08/24/1999	8.14	3.91
		11/24/1999	7.73	4.32

TABLE A-1

Monitoring Well Water Level Summary
143rd CCSQ, Seattle ANGS, Seattle, Washington

Monitoring Well	Measuring Point Elevation (ft amsl)	Date	Depth to Water (ft bmp)	Water Level Elevation (ft amsl)
MW-5	13.94	10/22/96	10.06	3.88
		12/17/96	9.06	4.88
		1/14/97	8.01	5.93
		4/11/97	8.36	5.58
		7/10/97	9.23	4.71
		9/1/98	10.15	3.79
		11/24/98	10.11	3.83
		02/24/1999	7.84	6.10
		05/18/1999	8.98	4.96
		08/24/1999	9.97	3.97
		11/23/1999	9.74	4.20
MW-6	11.62	9/1/98	8.38	3.24
		11/24/98	7.64	3.98
		02/24/1999	5.50	6.12
		05/18/1999	6.55	5.07
		08/24/1999	7.54	4.08
		11/23/1999	7.28	4.34
MW-7	12.17	9/1/98	6.75	5.42
		11/24/98	7.30	4.87
		02/24/1999	5.94	6.23
		05/18/1999	7.05	5.12
		08/24/1999	8.08	4.09
		11/23/1999	7.85	4.32
MW-8	11.90	9/1/98	8.89	3.01
		11/24/98	8.02	3.88
		02/24/1999	5.82	6.08
		05/18/1999	6.95	4.95
		08/24/1999	7.95	3.95
		11/24/1999	7.59	4.31
MW-9	14.30	9/1/98	9.78	4.52
		11/24/98	8.00	6.30
		02/24/1999	6.76	7.54
		05/18/1999	7.69	6.61
		08/24/1999	8.42	5.88
		11/23/1999	8.43	5.87
MW-10	14.97	9/1/98	10.42	4.55
		11/24/98	9.69	5.28
		02/24/1999	7.40	7.57
		05/18/1999	8.43	6.54
		08/25/1999	9.00	5.97
		11/23/1999	9.45	5.52

Notes:

ft amsl = Feet above mean sea level
ft bmp = Feet below measuring point

Appendix B

APPENDIX B

LABORATORY DATA SUMMARY SHEETS

6067.24 RCL 12/16/99

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082

December 9, 1999

ERM-West
915 118th Avenue S.E.
Suite 130
Bellevue WA 98005

Attention : Rob Leet

Project Number : ~~6007.24~~ 6067.24

Project Name : Seattle ANGS

Dear Mr. Leet:

On November 24, 1999, MultiChem Analytical Services received 18 samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and quality control data are enclosed.

Sincerely,

Tamara B. Jerome
Senior Project Manager

TBJ/hal/trm

Enclosure

cc: Anita Quesada
ERM - West, Inc.

560 Naches Avenue SW, Suite 101, Renton, Washington 98055-2200 • 425-228-8335 • FAX 425-228-8336 • 1-800-609-0580 • info@multichem.com

KCSlip4 42648

SEA409178

MAS I.D. # 911082

MultiChem
ANALYTICAL SERVICES

SAMPLE CROSS REFERENCE SHEET

CLIENT : ERM-WEST
PROJECT # : 6007.23
PROJECT NAME : SEATTLE ANGS

MAS #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
911082-1	BS-006PZ-99/00-2	11/23/99	WATER
911082-2	MW-2-99/00-2	11/23/99	WATER
911082-3	MW-1-99/00-2	11/23/99	WATER
911082-4	MW-10-99/00-2	11/23/99	WATER
911082-5	MW-9-99/00-2	11/23/99	WATER
911082-6	BS-004PZ-99/00-2	11/23/99	WATER
911082-7	BS-005PZ-99/00-2	11/23/99	WATER
911082-8	MW-3-99/00-2	11/23/99	WATER
911082-9	MW-6-99/00-2	11/23/99	WATER
911082-10	MW-7-99/00-2	11/23/99	WATER
911082-11	MW-5-99/00-2	11/23/99	WATER
911082-12	MW-5-99/00-2FA	11/23/99	WATER
911082-13	MW-5-99/00-2FT	11/23/99	WATER
911082-14	TB112399-1	11/23/99	WATER
911082-15	MW-8-99/00-2	11/24/99	WATER
911082-16	MW-8-99/00-2D	11/24/99	WATER
911082-17	MW-8-99/00-2R	11/24/99	WATER
911082-18	MW-4-99/00-2	11/24/99	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	18

MAS STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082

ANALYTICAL SCHEDULE

CLIENT : ERM-WEST
PROJECT # : 6007.23
PROJECT NAME : SEATTLE ANGS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
VOLATILE ORGANICS ANALYSIS	GCMS	EPA 8260B	R

R = MAS - Renton
ANC = MAS - Anchorage
SUB = Subcontract

KCSlip4 42650

MAS I.D. # 911082

MultiChem
ANALYTICAL SERVICES

CASE NARRATIVE

CLIENT : ERM-WEST
PROJECT # : 6007.23
PROJECT NAME : SEATTLE ANGS

CASE NARRATIVE: VOLATILE ORGANICS ANALYSIS

The following anomalies were associated with the preparation and/or analysis of the samples in this accession:

Per client request, initial calibration for all quantified compounds has been performed using average response factors. In all cases, except for the target compound vinyl acetate, the percent relative standard difference (%RSD) is <30% in the initial calibration. In the case of vinyl acetate, all associated continuing calibrations indicated a potential high bias, with vinyl acetate not detected in any of the associated samples. In order to achieve this %RSD criterion, some of the high or low end calibration points may have been eliminated from the initial calibration. However, the initial calibration of all target compounds contains at least five consecutive points over the calibration range, with the low point at or below the reporting limit, and the high point defining the upper limit of the calibration range. No further corrective action was performed.

The initial undiluted analysis of the sample identified as 911082-17 (MW-8-99/00-2R) caused a fatal instrument error due to the presence of an early eluting nontarget compound. It was necessary to analyze this sample with ten fold base dilution. Reporting limits have been adjusted accordingly. No further corrective action was performed.

All other associated quality assurance/quality control (QA/QC) parameters were within established MultiChem control limits.

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: N/A
PROJECT #	: 6007.23	DATE RECEIVED	: N/A
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MAS I.D. # 911082

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: N/A
PROJECT #	: 6007.23	DATE RECEIVED	: N/A
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	91	81 - 130
TOLUENE-D8	102	80 - 120
BROMOFLUOROBENZENE	96	75 - 118

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SEA409183

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: N/A
PROJECT #	: 6007.23	DATE RECEIVED	: N/A
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: N/A
PROJECT #	: 6007.23	DATE RECEIVED	: N/A
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	92	81 - 130
TOLUENE-D8	99	80 - 120
BROMOFLUOROBENZENE	93	75 - 118

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: N/A
PROJECT #	: 6007.23	DATE RECEIVED	: N/A
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

KCSlip4 42656

MAS I.D. # 911082

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: N/A
PROJECT #	: 6007.23	DATE RECEIVED	: N/A
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: METHOD BLANK	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	90	81 - 130
TOLUENE-D8	99	80 - 120
BROMOFLUOROBENZENE	94	75 - 118

KCSlip4 42657

SEA409187

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-1

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: BS-006PZ-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MAS I.D. # 911082-1

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: BS-006PZ-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	88	81 - 130
TOLUENE-D8	96	80 - 120
BROMOFLUOROBENZENE	104	75 - 118

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-2

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-2-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

KCSlip4 42660

MAS I.D. # 911082-2

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-2-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	92	81 - 130
TOLUENE-D8	99	80 - 120
BROMOFLUOROBENZENE	106	75 - 118

KCSlip4 42661

SEA409191

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-3

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-1-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MAS I.D. # 911082-3

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-1-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	90	81 - 130
TOLUENE-D8	95	80 - 120
BROMOFLUOROBENZENE	103	75 - 118

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MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-4

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-10-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

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SEA409194

MAS I.D. # 911082-4

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-10-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	91	81 - 130
TOLUENE-D8	93	80 - 120
BROMOFLUOROBENZENE	102	75 - 118

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-5

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-9-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

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SEA409196

MAS I.D. # 911082-5

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-9-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	94	81 - 130
TOLUENE-D8	96	80 - 120
BROMOFLUOROBENZENE	98	75 - 118

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-6

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: BS-004PZ-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	3.1
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

KCSlip4 42668

MAS I.D. # 911082-6

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ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: BS-004PZ-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	93	81 - 130
TOLUENE-D8	97	80 - 120
BROMOFLUOROBENZENE	103	75 - 118

KCSlip4 42669

SEA409199

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-7

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: BS-005PZ-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MAS I.D. # 911082-7

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: BS-005PZ-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	93	81 - 130
TOLUENE-D8	94	80 - 120
BROMOFLUOROBENZENE	102	75 - 118

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-8

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-3-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MAS I.D. # 911082-8

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-3-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	93	81 - 130
TOLUENE-D8	95	80 - 120
BROMOFLUOROBENZENE	102	75 - 118

KCSlip4 42673

SEA409203

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-9

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-6-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	2.9
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MAS I.D. # 911082-9

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-6-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	95	81 - 130
TOLUENE-D8	97	80 - 120
BROMOFLUOROBENZENE	101	75 - 118

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-10

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-7-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	1.5
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MAS I.D. # 911082-10

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-7-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	92	81 - 130
TOLUENE-D8	95	80 - 120
BROMOFLUOROBENZENE	102	75 - 118

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-11

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-5-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	2.2
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

KCSlip4 42678

SEA409208

MultiChem
ANALYTICAL SERVICES

AS I.D. # 911082-11

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-5-99/00-2	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	94	81 - 130
TOLUENE-D8	95	80 - 120
BROMOFLUOROBENZENE	102	75 - 118

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-12

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-5-99/00-2FA	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

KCSlip4 42680

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-12

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-5-99/00-2FA	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	93	81 - 130
TOLUENE-D8	97	80 - 120
BROMOFLUOROBENZENE	99	75 - 118

KCSlip4 42681

SEA409211

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-13

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-5-99/00-2FT	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	37
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-13

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-5-99/00-2FT	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	92	81 - 130
TOLUENE-D8	98	80 - 120
BROMOFLUOROBENZENE	100	75 - 118

KCSlip4 42683

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-14

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: TB112399-1	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	<1.0
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

KCSlip4 42684

SEA409214

MAS I.D. # 911082-14

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/23/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: TB112399-1	DATE ANALYZED	: 11/29/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	92	81 - 130
TOLUENE-D8	98	80 - 120
BROMOFLUOROBENZENE	101	75 - 118

MAS I.D. # 911082-15

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/24/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-8-99/00-2	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	4.2
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

KCSlip4 42686

MAS I.D. # 911082-15

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/24/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-8-99/00-2	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	94	81 - 130
TOLUENE-D8	97	80 - 120
BROMOFLUOROBENZENE	100	75 - 118

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SEA409217

MultiChem
ANALYTICAL SERVICES

MAS I.D. # 911082-16

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/24/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-8-99/00-2D	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	4.3
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

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SEA409218

MAS I.D. # 911082-16

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/24/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-8-99/00-2D	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	95	81 - 130
TOLUENE-D8	97	80 - 120
BROMOFLUOROBENZENE	99	75 - 118

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SEA409219

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ANALYTICAL SERVICES

MAS I.D. # 911082-17

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/24/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-8-99/00-2R	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 10

COMPOUNDS	RESULTS
CHLOROMETHANE	<50
VINYL CHLORIDE	<10
BROMOMETHANE	<10
CHLOROETHANE	<10
TRICHLOROFLUOROMETHANE	<10
ACETONE	<100
1,1-DICHLOROETHENE	<10
METHYLENE CHLORIDE	<50
CARBON DISULFIDE	<50
TRANS-1,2-DICHLOROETHENE	<10
1,1-DICHLOROETHANE	<10
VINYL ACETATE	<100
2-BUTANONE	<100
CHLOROFORM	<10
CIS-1,2-DICHLOROETHENE	<10
1,1,1-TRICHLOROETHANE	<10
1,2-DICHLOROETHANE	<10
CARBON TETRACHLORIDE	<10
BENZENE	<10
1,2-DICHLOROPROPANE	<10
TRICHLOROETHENE	<10
BROMODICHLOROMETHANE	<10
CIS-1,3-DICHLOROPROPENE	<30
4-METHYL-2-PENTANONE	<100
TRANS-1,3-DICHLOROPROPENE	<30
1,1,2-TRICHLOROETHANE	<10
TOLUENE	<10
CHLORODIBROMOMETHANE	<20
2-HEXANONE	<100
TETRACHLOROETHENE	<10
CHLOROBENZENE	<10
ETHYLBENZENE	<10
BROMOFORM	<30

MAS I.D. # 911082-17

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ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/24/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-8-99/00-2R	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 10

COMPOUNDS	RESULTS
(m+p)-XYLENE	<10
STYRENE	<10
O-XYLENE	<10
1,1,2,2-TETRACHLOROETHANE	<10
1,3-DICHLOROBENZENE	<20
1,4-DICHLOROBENZENE	<20
P-ISOPROPYLTOLUENE	<20
1,2-DICHLOROBENZENE	<20

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	89	81 - 130
TOLUENE-D8	98	80 - 120
BROMOFLUOROBENZENE	100	75 - 118

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SEA409221

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ANALYTICAL SERVICES

MAS I.D. # 911082-18

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/24/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-4-99/00-2	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
CHLOROMETHANE	<5.0
VINYL CHLORIDE	<1.0
BROMOMETHANE	<1.0
CHLOROETHANE	<1.0
TRICHLOROFLUOROMETHANE	<1.0
ACETONE	<10
1,1-DICHLOROETHENE	<1.0
METHYLENE CHLORIDE	<5.0
CARBON DISULFIDE	<5.0
TRANS-1,2-DICHLOROETHENE	<1.0
1,1-DICHLOROETHANE	<1.0
VINYL ACETATE	<10
2-BUTANONE	<10
CHLOROFORM	<1.0
CIS-1,2-DICHLOROETHENE	<1.0
1,1,1-TRICHLOROETHANE	<1.0
1,2-DICHLOROETHANE	<1.0
CARBON TETRACHLORIDE	<1.0
BENZENE	<1.0
1,2-DICHLOROPROPANE	<1.0
TRICHLOROETHENE	2.4
BROMODICHLOROMETHANE	<1.0
CIS-1,3-DICHLOROPROPENE	<3.0
4-METHYL-2-PENTANONE	<10
TRANS-1,3-DICHLOROPROPENE	<3.0
1,1,2-TRICHLOROETHANE	<1.0
TOLUENE	<1.0
CHLORODIBROMOMETHANE	<2.0
2-HEXANONE	<10
TETRACHLOROETHENE	<1.0
CHLOROBENZENE	<1.0
ETHYLBENZENE	<1.0
BROMOFORM	<3.0

MAS I.D. # 911082-18

MultiChem
ANALYTICAL SERVICES

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: ERM-WEST	DATE SAMPLED	: 11/24/99
PROJECT #	: 6007.23	DATE RECEIVED	: 11/24/99
PROJECT NAME	: SEATTLE ANGS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-4-99/00-2	DATE ANALYZED	: 11/30/99
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8260B	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
(m+p)-XYLENE	<1.0
STYRENE	<1.0
O-XYLENE	<1.0
1,1,2,2-TETRACHLOROETHANE	<1.0
1,3-DICHLOROBENZENE	<2.0
1,4-DICHLOROBENZENE	<2.0
P-ISOPROPYLTOLUENE	<2.0
1,2-DICHLOROBENZENE	<2.0

SURROGATE PERCENT RECOVERY		LIMITS
1,2-DICHLOROETHANE-D4	91	81 - 130
TOLUENE-D8	98	80 - 120
BROMOFLUOROBENZENE	101	75 - 118

KCSlip4 42693

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Appendix C

APPENDIX C

QUALITY CONTROL DATA VALIDATION REPORT - NOVEMBER 1999 GROUNDWATER DATA

APPENDIX C

QUALITY CONTROL DATA VALIDATION REPORT - NOVEMBER 1999 GROUNDWATER DATA

Analytical data are the basis for evaluating the environmental conditions at the Seattle Air National Guard Station (Seattle ANGS) in Seattle, Washington. A primary objective of environmental sampling conducted at the site is to obtain accurate data that reflect actual conditions.

This report addresses groundwater analytical data collected in November 1999 at the Seattle ANGS as part of a quarterly monitoring program. Thirteen primary groundwater samples were analyzed for volatile organic analytes using United States Environmental Protection Agency (USEPA) Method 8260. To ensure that data quality was acceptable for decision-making purposes, analytical data for this project were validated. This process identifies limitations on the use of the data, or data that should not be used for decision-making purposes. The quality of the data was assessed and any necessary qualifiers were applied following the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (February 1994).

Environmental Resources Management (ERM) validated data for compliance with the following quality assurance/quality control (QA/QC) project- and/or method-prescribed criteria:

- Holding Time and Preservation: The holding time is the period of time between collection of the sample and preparation/analysis of the sample. Analyses performed for this project have method-prescribed holding times. Preservation refers to the temperature at which the samples are received at the laboratory, as well as any pH anomalies noted by the laboratory for acid-preserved samples.

- Calibration: The analysis of target analytes at a range of concentrations to develop a graphical plot of instrument response against the different analyte concentrations. An initial calibration curve establishes the graphical plot, and the continuing calibration

verification monitors daily instrument linearity against the initial calibration.

- Blank Samples: The preparation and analysis of samples from reagent (contaminant-free) water. Blank samples for this investigation included method, trip, rinsate, and field blanks. Detections in a blank sample indicate laboratory, handling, or field contamination.

- Internal Standards: The addition of compounds similar to target analytes of interest that are added to sample aliquots for organic analysis. The internal standards are used to quantitatively and qualitatively evaluate retention time and instrument response for each analytical run.

- Spike Samples: The preparation and analysis of an environmental sample or a sample of reagent water spiked with a subset of target analytes at known concentrations. The results of the spike analysis measure laboratory accuracy in the reagent sample, and results from the environmental sample spike measure potential interferences from the sample matrix.

- Surrogate Spikes: The addition of compounds similar to target analytes of interest that are added to sample aliquots for organic analysis. Surrogate spikes measure possible interferences from the sample matrix for the analysis of target analytes.

- Duplicate Samples: The preparation and analysis of an additional aliquot of the sample. The results from duplicate analysis measure potential heterogeneity of contaminant concentrations in the samples.

The following data qualifiers were used as appropriate during this validation process:

U: The analyte was analyzed for, but was not detected above the reported quantitation limit.

J: The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

UJ: The analyte was not detected above the reported sample quantitation limit; however, the reported quantitation limit was approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R: The sample results were rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte could not be verified.

None of the November 1999 groundwater data was rejected based on the data validation. All of the data, including qualified data, are acceptable and can be used for decision-making purposes.

The following discussion addresses the results of the data validation for each of the QA/QC components listed above.

Holding Time and Preservation

The USEPA has established maximum recommended holding times for the analyses performed on the November 1999 groundwater samples. The USEPA has also defined the acceptable temperature range at which samples must be stored to maintain sample preservation. Holding times and sample temperatures extending beyond the maximum can negatively affect sample integrity (e.g., loss of volatile compounds, biodegradation), and impacted samples are qualified depending on the severity of the exceedence and the analytes of concern. The maximum recommended holding time for USEPA Method 8260 is 14 days for acid-preserved samples and 7 days for unpreserved samples. The recommended temperature range for sample storage is 2 to 6 degrees Celsius.

Each of the sample analysis results was reviewed for compliance with the method-prescribed preparation and analysis holding times. None of the analyses was performed outside of the prescribed holding time. Accordingly, sample results were not compromised by an excessive period between sample collection and analysis.

The temperature of the samples upon receipt at the laboratory was also reviewed for compliance with method requirements. The samples were received within the method-prescribed temperature range. None of the samples were compromised by out-of-range temperature preservation.

Calibration Results

Before an analytical instrument is used for sample analysis, the instrument should be calibrated to within USEPA method specifications. The purpose of this calibration is to ensure that the instrument is appropriately responsive to measurable chemical concentrations. If an instrument is not properly calibrated, it may not be capable of producing acceptable

quantitative, qualitative, and reproducible data. For example, positive detections of a given analyte could contain an undetermined degree of inaccuracy if the instrument is out of calibration, although the results may still be considered valid. In the case of ND analytes, the associated reporting limit would be similarly affected; however, such results would still be considered NDs.

Two types of calibration data were reviewed: initial calibration verification (ICV) and continuing calibration verification (CCV). The ICV consisted of standards that were analyzed at five or more concentrations. These concentrations ranged from the reporting limit to the upper linear range of the instrument. Average response factors from the ICV were used to calculate sample results. The laboratory evaluated the ICVs using relative standard deviation (RSD). The reported RSDs were compared to the method-prescribed acceptance criteria during the data validation. The only ICV target analyte with an RSD that exceeded the acceptable method-prescribed criterion was vinyl acetate. All of the vinyl acetate data were non-detect and were qualified "UJ," estimated detection limit, based on the initial calibration results (Table C-1).

The CCV is analyzed either daily or every 12 hours to ensure the instrument response is still within method performance criteria for linearity. The CCV consisted of analyzing a standard at one concentration; the concentration of this standard was generally in the mid-range of the ICV standard concentrations. The laboratory calculated the percent difference (%D) between the CCV and the ICV. The %Ds were compared to the method-prescribed acceptance criteria during the data validation. Table C-1 lists the CCV %Ds that were above the method-prescribed criteria and the samples associated with each CCV, along with the applied data qualifiers. None of the analytes associated with an elevated %D were detected in the project samples.

Blank Samples

Blank samples are prepared in the laboratory or in the field and are carried through the analytical process. The purpose of a blank sample is to test for contamination resulting from laboratory, shipping, or other sample-handling activities. Blank samples are analyzed and evaluated for detections of target analytes. If target analytes are detected in a blank sample, these detections indicate that some element of the sample collection or analysis process has introduced contaminants not present in the original environmental sample aliquot. If target analytes are detected

TABLE C-1

Data Qualified Based on Calibration Results
143rd CCSQ, Seattle ANGS, Seattle, Washington

Analytical Parameter	Calibration (ICV/CCV)	Associated Samples	Instrument ID	Date	Target Compound	RSD or %D	ERM Qualifier*
VOCs	ICV	BS-006PZ-99/00-2 MW-2-99/00-2 MW-1-99/00-2 MW-10-99/00-2 MW-9-99/00-2 BS-004PZ-99/00-2 BS-005PZ-99/00-2 MW-3-99/00-2 MW-6-99/00-2 MW-7-99/00-2 MW-5-99/00-2 MW-5-99/00-2FA MW-5-99/00-2FT TB112399-1 MW-8-99/00-2 MW-8-99/00-2D MW-4-99/00-2 MW-8-99/00-2R	HP4	10/28/1999	Vinyl Acetate	32.7	UJ
	CCV	BS-006PZ-99/00-2 MW-2-99/00-2 MW-1-99/00-2 MW-10-99/00-2 MW-9-99/00-2	HP4	11/29 am	Acetone Vinyl Acetate 2-Butanone 2-Hexanone p-Isopropyltoluene	61.0 58.2 43.9 34.2 27.1	UJ UJ UJ UJ UJ
	CCV	BS-004PZ-99/00-2 BS-005PZ-99/00-2 MW-3-99/00-2 MW-6-99/00-2 MW-7-99/00-2 MW-5-99/00-2 MW-5-99/00-2FA MW-5-99/00-2FT TB112399-1 MW-8-99/00-2 MW-8-99/00-2D	HP4	11/29 pm	Acetone Vinyl Acetate 2-Butanone 2-Hexanone	45.3 51.1 30.9 31.6	UJ UJ UJ UJ
	CCV	MW-4-99/00-2 MW-8-99/00-2R	HP4	11/30 am	Vinyl Acetate	60.3	UJ

Notes:

UJ = Reported detection limits for the listed compounds and samples are estimated concentrations.
TB = Trip blank sample
FA = Field blank sample prepared with ASTM Type II water
FT = Field blank sample prepared with tap water
D = Duplicate sample
R = Rinsate blank sample
RSD = Relative standard deviation
%D = Percent difference
VOC = Volatile organic compound
ICV= Initial calibration verification
CCV= Continuing calibration verification
* Data qualifiers apply to listed samples

in a blank sample, then all associated data must be evaluated to determine whether:

- Those data have been similarly impacted; or
- The blank detections are an isolated occurrence not representative of other data.

The four types of blank samples analyzed and reported with the groundwater samples collected in November 1999 were method, trip, rinsate, and field blank samples. Preparation, handling, and analysis of these blank samples are summarized below.

1. Method blank samples monitor for potential laboratory contamination of samples. Method blank samples were prepared in the laboratory by taking an aliquot of reagent water through all preparation and analysis steps. A method blank was prepared and analyzed with each batch of environmental samples.

2. Trip blank samples monitor for potential contamination of samples during collection and transportation to the laboratory. Trip blank samples were prepared by filling a volatile organics analysis (VOA) vial with an aliquot of reagent water and sealing it with a Teflon-lined-septum lid. The trip blank sample travels with the filled aqueous sample containers to the laboratory.

3. Rinsate blank samples monitor for potential contamination of project samples from inadequate decontamination of sample collection equipment. Rinsate blank samples were prepared in the field by pouring American Society for Testing and Materials (ASTM) Type II reagent-grade water over the decontaminated sample collection equipment. The water was collected in clean sample containers supplied by the laboratory. Rinsate blank samples were labeled with an "R" identifier at the end of the sample ID.

4. Field blank samples monitor for potential contamination of project samples from ambient conditions at the sample collection site. Field blank samples were prepared at sample collection locations by slowly pouring tap water or ASTM Type II water into clean sample containers supplied by the laboratory. Field blank samples prepared with tap water were labeled with an "FT" identifier at the end of the sample ID. The identifier "FA" was used to designate field blank samples prepared with ASTM Type II water.

No target analytes were detected in the method, trip, or rinsate blank samples. The common drinking water contaminants chloroform and bromodichloromethane were reported in the tap water field blank sample. Neither of these compounds was detected in any of the associated samples, and none of the results required qualification based on the tap water field blank results.

Spike Samples

A spike sample is a QC sample that is prepared and analyzed by the laboratory. The laboratory prepares, analyzes, and reports spike sample results to demonstrate their ability to properly analyze, detect, and quantify target analytes. A spike sample result is typically reported as the amount of analyte detected divided by the known amount spiked into the sample, and is commonly referred to as percent recovery. The percent recovery is then compared to an established limit range. [1] The two types of spike samples analyzed with the project samples were matrix and blank spikes.

1. Matrix spike (MS) samples consist of an aliquot of an environmental sample that is spiked with known concentrations of a subset of target analytes. A matrix spike duplicate (MSD) sample is a second (duplicate) spike sample prepared and analyzed with the MS sample. MS samples are used to monitor potential interference from the sample matrix for target analytes. A low MS recovery may indicate low-biased sample results; a high MS recovery may indicate high-biased sample results.

2. Blank spike samples, commonly referred to as laboratory control samples (LCS), consist of an aliquot of reagent water that is spiked with known concentrations of a subset of target analytes. The LCS sample is used to monitor laboratory accuracy without the bias of a sample matrix. LCS recoveries outside of acceptable limits may indicate poor laboratory accuracy.

All of the MS and LCS recoveries were within acceptable limits. The acceptable MS and LCS recoveries indicate minimal matrix interference and acceptable laboratory accuracy for the November 1999 groundwater data.

[1] In most cases, the prescribed analytical method will specify protocol to develop appropriate limit ranges. In some cases, however, limit ranges are established by the laboratory in the method procedures.

Internal Standard Responses

Under USEPA methods, a given analyte list for organic compounds is segregated by chemical properties and retention time into one or more subsets. A USEPA-defined internal standard with comparable chemical properties and retention times is assigned to each subset of analytes. The laboratory adds a known concentration of an internal standard to each sample, including laboratory QC samples (e.g., calibration standards, MS, method blank samples), prior to analysis. The instrument internal standard response for each sample is compared to the internal standard response in the daily CCV. The sample internal standard area count must be within the range of 0.5 to 2 times the CCV area count, and the retention time must be within ±30 seconds of the CCV retention time. If the area count and/or retention time measured for the sample is outside the acceptable range, quantitation results for the associated analyte subset may be biased. Interferences from the sample matrix are typically responsible for internal standard responses that are consistently outside acceptable ranges; most matrix interferences cause a consistently high or low bias.

Internal standards were added to each of the project samples analyzed for VOCs. The internal standard responses were within acceptable limits, indicating minimal matrix interference and acceptable sample quantitation.

Surrogate Spikes

A surrogate spike is similar to an internal standard; it is chemically similar to the target analytes and is only used in organic analyses. The difference between surrogate spikes and internal standards is that surrogate spikes are used only to assess possible interferences from the sample matrix, whereas internal standards are used to quantitate target analytes while accounting for any interferences from the sample matrix. Surrogate spike results are typically reported in terms of percent recovery, which is calculated by dividing the amount of surrogate detected in the sample by the known amount of surrogate added to the sample.

For the November 1999 groundwater data, surrogate recoveries were compared to the laboratory-generated limits of acceptance. The surrogate recoveries were within acceptable limits, indicating that sample results were not subject to interferences from the sample matrix.

Duplicate Samples

A duplicate sample is a second aliquot of a sample that is treated the same as the primary sample. A duplicate sample analysis is performed to measure the precision of the method and possible heterogeneity of analyte concentrations in the sample matrix. Duplicate field samples are collected to measure matrix heterogeneity.

Laboratory duplicate analyses for the project samples consisted of matrix spike duplicate analyses. The laboratory calculated the relative percent difference (RPD) between the MS and MSD spike concentrations. The calculated RPDs were compared to method-prescribed or laboratory-generated acceptable limits. A field duplicate sample also was collected and submitted for analysis, and an RPD was calculated for detected analytes.

The duplicate sample RPDs were within acceptable limits, indicating acceptable analytical precision and minimal matrix heterogeneity.

Overall Assessment

None of the Seattle ANGS analytical data for groundwater samples collected in November 1999 were rejected. The data set is 100 percent complete and meets the project goal for completeness. The data can be used for decision-making purposes. The quality of the November 1999 groundwater analytical data is acceptable for the preparation of technically defensible documents.

Appendix D

APPENDIX D

CHAIN-OF-CUSTODY FORMS

MultiChem
ANALYTICAL SERVICES

500 Naches Ave. SW Suite 101 Renton, WA 98055
(800) 609-0580 • (425) 228-8335 • FAX (425) 228-8336

LAB NUMBER: 9910Sz

DATE: 11/25/99
PAGE: 1 of 2

COMPANY: ERM
ADDRESS: 915 118th Ave SE #130
Bellevue WA 98005
PHONE: (425) 462-8591 FAX (425) 455-2571
PROJ. MGR / CONTACT: Rob Leet
PROJECT NUMBER: 0007.24
PROJECT NAME: Seattle AIG
DISPOSAL: ☒ MAS ☐ HOLD ☐ RETURN

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Total # of Containers
BS-006PZ-99/00-2	11/23/99	910	W	1	3
MW-2-99/00-2	11/23/99	945	W	2	3
MW-1-99/00-2	11/23/99	1045	W	3	3
MW-10-99/00-2	11/24/99	1130	W	4	3
MW-9-99/00-2	11/23/99	1200	W	5	3
BS-004PZ-99/00-2	11/23/99	1240	W	6	3
BS-005PZ-99/00-2	11/23/99	1345	W	7	3
MW-3-99/00-2	11/23/99	1430	W	8	3
MW-6-99/00-2	11/23/99	1500	W	9	3
MW-7-99/00-2	11/23/99	1535	W	10	3
MW-5-99/00-2	11/23/99	1610	W	11	3
MW-5-99/00-2FA	11/23/99	1555	W	12	3

FUELS: TPH-HCID; BETX / TPH-G BETX / AK101; BETX (by 8021); TPH-G; TPH-D TPHD-extended; 8015 modified; 418.1; 413.2; AK-GRO AK101; AK-DRO AK102 / 103

ORGANIC COMPOUNDS: 8240 / 8260 GCMS Volatiles; 8270 GCMS Semivolatiles; 8081 Pesticides / PCBs; PCB only (by 8081) STD / LL; 8021 Halogenated VOCs; 8021 Aromatic VOCs; 8310 HPLC PAHs; 8041 Phenols; 8151 OC Herbicides

METALS: Metals indicate below; Total / Dissolved Lead; RCRA Metals (8); PP Metals (13); TAL Metals (23)

TCLP: TCLP 8240 (ZHE); TCLP 8270 Semivolatiles; TCLP 8081 Pesticides; TCLP 8151 Herbicides; TCLP Metals

OTHER

SAMPLE RECEIPT	
TOTAL # OF CONTAINERS	☐ YES ☐ NO
COC SEALS PRESENT?	☐ YES ☐ NO
COC SEALS INTACT?	☐ YES ☐ NO
RECEIVED COLD?	☐ YES ☐ NO
RECEIVED INTACT?	☐ YES ☐ NO
RECEIVED VIA:	

TAT:
- ☐ 24 HOURS
- ☐ 48 HOURS
- ☐ 72 HOURS
- ☐ 7 DAYS
- ☐ SP
- ☒ STANDARD

SPECIAL INSTRUCTIONS/COMMENTS:
MS/MSD on MW-5-99/00-2
Level IV documentation on all samples

METALS NEEDED:

RELINQUISHED BY:	RELINQUISHED BY:	RELINQUISHED BY:
SIGNATURE: [signature]	SIGNATURE:	SIGNATURE:
PRINT NAME: Chris Bailey	PRINT NAME:	PRINT NAME:
DATE: 11/24/99 TIME: 1100	DATE: TIME:	DATE: TIME:
COMPANY: ERM	COMPANY:	COMPANY:
RECEIVED BY:	**RECEIVED BY:**	**RECEIVED BY:**
SIGNATURE: [signature]	SIGNATURE:	SIGNATURE:
PRINT NAME: Tumer Peterson	PRINT NAME:	PRINT NAME:
DATE: 11/24/99 TIME: 1215	DATE: TIME:	DATE: TIME:
COMPANY: MAS	COMPANY:	COMPANY:

MAS USE ONLY: SUBCONTRACT LAB: PO #:

KCSlip4 42707

SEA409237

MultiChem ANALYTICAL SERVICES

560 Naches Ave. SW Suite 101 Renton, WA 98055
(800) 609-0580 • (425) 228-8335 • FAX (425) 228-8336

LAB NUMBER: 9911282

DATE: 11/25/99
PAGE: 2 of 2

COMPANY: ERM
ADDRESS: 915 118th Ave SE #130
Bellevue WA 98005
PHONE: (475) 462-8591 FAX (425) 455-2571
PROJ. MGR / CONTACT: Rob Lee
PROJECT NUMBER: 6067.24
PROJECT NAME: Seattle MGP
DISPOSAL: ☒ MAS ☐ HOLD ☐ RETURN

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
MW-5-99/00-2FT	11/23/99	1600	W	12
TB112399-1	11/23/99	—	W	13
MW-8-99/00-2	11/24/99	925	W	14
MW-8-99/00-2D	11/24/99	925	W	15
MW-8-99/00-2R	11/24/99	940	W	16
MW-4-99/00-2	11/24/99	1010	W	17

FUELS											ORGANIC COMPOUNDS										METALS					TCLP					OTHER					
TPH-HCID	BETX / TPH-G BETX / AK101	BETX (by 8021)	TPH-G	TPH-D TPHD-extended	8015 modified	418.1	413.2	AK-GRO AK101	AK-DRO AK102 / 103	8240 / 8260 GCMS Volatiles	8270 GCMS Semivolatiles	8081 Pesticides / PCBs	PCB only (by 8081) STD / LL	8021 Halogenated VOCs	8021 Aromatic VOCs	8310 HPLC PAHs	8041 Phenols	8151 OC Herbicides	Metals indicate below	Total / Dissolved Lead	RCRA Metals (8)	PP Metals (13)	TAL Metals (23)	TCLP 8240 (ZHE)	TCLP 8270 Semivolatiles	TCLP 8081 Pesticides	TCLP 8151 Herbicides	TCLP Metals							Total # of Containers
										/	/	/	/	/	/	/	/	/																3
										/	/	/	/	/	/	/	/	/																3
										/	/	/	/	/	/	/	/	/																3
										/	/	/	/	/	/	/	/	/																3
										/	/	/	/	/	/	/	/	/																3
										/	/	/	/	/	/	/	/	/																3

SAMPLE RECEIPT	
TOTAL # OF CONTAINERS	☐ YES ☐ NO
VOC SEALS PRESENT?	☐ YES ☐ NO
VOC SEALS INTACT?	☐ YES ☐ NO
RECEIVED COLD?	☐ YES ☐ NO
RECEIVED INTACT?	☐ YES ☐ NO
RECEIVED VIA:	

TAT:
- ☐ 24 HOURS
- ☐ 48 HOURS
- ☐ 72 HOURS
- ☐ 7 DAYS
- ☐ 5P
- ☒ STANDARD

SPECIAL INSTRUCTIONS/COMMENTS:
Level IV documentation on all samples

METALS NEEDED:

RELINQUISHED BY:	RELINQUISHED BY:	RELINQUISHED BY:
SIGNATURE:	SIGNATURE:	SIGNATURE:
PRINT NAME: Chris Bailey	PRINT NAME:	PRINT NAME:
DATE: 11/24/99 TIME: 1100	DATE: TIME:	DATE: TIME:
COMPANY: ERM	COMPANY:	COMPANY:
RECEIVED BY:	**RECEIVED BY:**	**RECEIVED BY:**
SIGNATURE:	SIGNATURE:	SIGNATURE:
PRINT NAME: Delaney Peterson	PRINT NAME:	PRINT NAME:
DATE: 11/24/99 TIME: 1115	DATE: TIME:	DATE: TIME:
COMPANY: MAS	COMPANY:	COMPANY:

MAS USE ONLY: SUBCONTRACT LAB: PO #:

KCSlip4 42708

SEA409238